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A new genus and species for *Dysgonia* (Lepidoptera, Erebidae, Erebinae) from Southeastern United States

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Abstract

Three North American species currently placed in the genus *Dysgonia* Hübner are moved to *Neadysgonia* **gen. n.** A fourth species, *N. telma*, is described from southeastern United States and a neotype is designated for closely related species *N. smithii*. The generic placement of the new genus is discussed.

Keywords

Taxonomy, *Dysgonia*, *Neadysgonia*, *Argyrostrotis*, United States

Introduction

The genus *Dysgonia* Hübner as herein restricted currently includes species ranging through the Mediterranean Region and possibly as far east as Australia (Berio 1965). Poole (1989) included species in *Dysgonia* that give it a world wide distribution, however, the genus as delimited by him is clearly polyphyletic (Holloway and Miller 2003). The three species of *Dysgonia* that occur in the United States form a distinct but related group that requires a new generic name. A fourth undescribed species was revealed

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by DNA barcoding and confirmed by characters of the genitalia. The purpose of this paper is to propose a new genus for species found in southeastern United States and describe the new species.

Materials and methods

Repository abbreviations

BMNH Natural History Museum, London, UK
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
JBS J. Bolling Sullivan, Beaufort, North Carolina, USA
MEM Mississippi Entomological Museum, Mississippi State, Mississippi, USA
MNHN Muséum national d'Histoire naturelle, Paris, France
USNM National Museum of Natural History, Washington, District of Columbia, USA
VAB Vernon A. Brou, Jr., Abita Springs, Louisiana, USA

Genitalia were prepared by digestion in 10% potassium hydroxide, dissected in water, stained with chlorocreosol black or eosin, and slide mounted. Barcoding of 658 base-pairs of the cytochrome oxidase mitochondrial gene (COI) was done by Paul Hebert and his colleagues at the University of Guelph and compared by nearest neighbor analyses (Ratnasingham and Hebert 2007).

Neadysgonia Sullivan, gen. n.

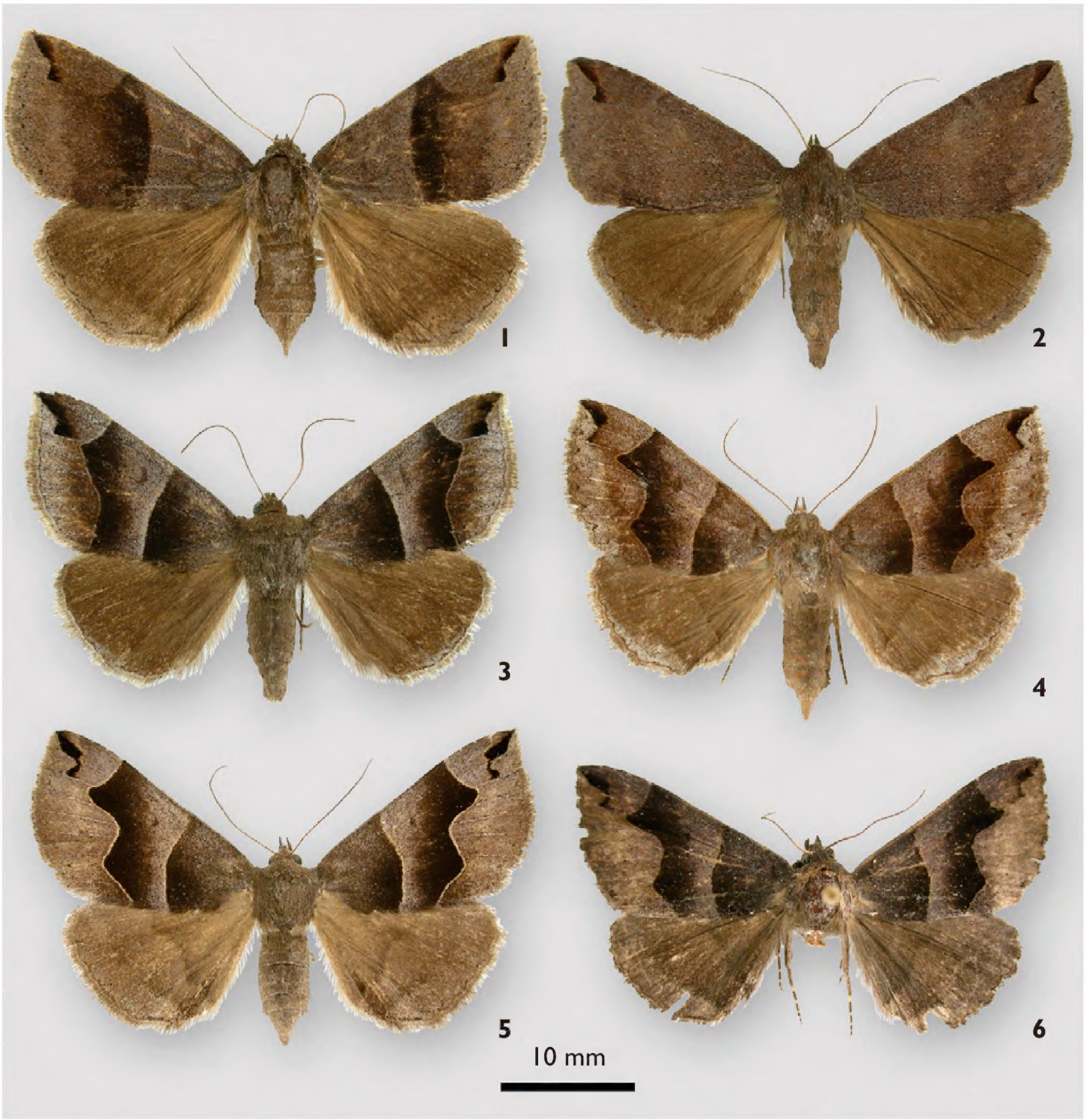
urn:lsid:zoobank.org:act:09B7F994-7059-4CC1-9AEA-9E0CD1722DEE

Type species. *Ophiusa smithii* Guenée, 1852

Etymology. The name is a combination of Nearctic and *Dysgonia*.

Diagnosis. The European species *Dysgonia algira* (L.) is the type-species for the genus *Dysgonia*. The male genitalia have a single coremata, as does *Neadysgonia*, but have three not two projections from the base of the valva. The tegumen lacks the lateral projection that is so characteristic of *Neadysgonia*. The dorsal tuft of the uncus in *Dysgonia* is composed of two kinds of hairs, one short, one long, whereas in *Neadysgonia* only the single longer hairs are present. The tip of the uncus is slightly bifurcate in *Neadysgonia* but strongly so in *Dysgonia*. The two genera occupy completely different geographical ranges.

Superficially, the species of *Neadysgonia* found in the southeastern United States form a compact group. They are similar in size and maculation (Figs 1–6), particularly the apical trapezoidal mark that often appears to be in the form of a comma, and the course of the postmedial line. The species *Neadysgonia similis* (Guenée, 1852) (Figs 1–2) occurs in two forms, one immaculate, another showing the pattern elements similar to those of the other species.



Figures 1–6. Adults of *Neadysgonia*. **1** *Neadysgonia similis* (Gn.) female, Holly Shelter Gamelands, Pender Co., North Carolina. 23 April 1995, J. Bolling Sullivan **2** *Neadysgonia similis* (Gn.) female, Croatan National Forest Road 147, Craven Co., North Carolina, 22 April 1998, J. Bolling Sullivan **3** *Neadysgonia consobrina* (Gn.) male, 4.2 mi. N. Abita Springs, St. Tammany Parish, Louisiana, 14 March 2008, V. A. Brou **4** *Neadysgonia smithii* (Gn.) female, Greenbank Bluff, Brunswick Co., North Carolina, 27 August 1995, J. Bolling Sullivan **5** *Neadysgonia telma* Sullivan female, 3 mi. N. Lucedale, George Co., Mississippi, 19–31 March 1996, R. Kergosien **6** *Neadysgonia telma* Sullivan Holotype male, Lake Waccamaw State Park, Columbus Co., North Carolina, 21 June 2009, J. Bolling Sullivan.

Three species, *N. consobrina* (Guenée, 1852), *N. similis* (Guenée, 1852) and *N. smithii* (Guenée, 1852), currently placed in *Dysgonia* are transferred to *Neadysgonia*.

Four species that occur in Central and South America were included in *Dysgonia* Poole (1989), and there are several undescribed species. They have two coremata and male genitalic characters that place them closer to some of the genera removed from *Dysgonia* by Holloway and Miller (2003).

Description. Palpi short, upcurved. Antennae filiform. Head and frons brown, vestiture hairy, some scales slightly spatulate. Legs brownish, joints cream, two pairs of tibial spurs on hind tibia. Forewing with postmedial line (PM) cream or white with one or two points directed toward margin. Darkened area proximal to PM line fades basally, except in *N. similis* where PM line is most distinct proximally and fades distally. Medial area matches ground color and stops abruptly at antemedial line (AM). AM line thin, cream or white with darkened area proximally that fades toward base of wing. In *N. similis* AM line wavy distally and ground color extends to base of wing. Hindwing brown with only trace of PM line. Underside brown with medial line visible as dark line. Wing venation typical for erebines. *Male genitalia* – Uncus variable, either spatulate and expanded medially, or tapered to a point or points. No superuncus. Tegumen with outward pointing medial projection. In *N. similis* tegumen forms a right angle at rounded projection. Valva moderate, often tapering gradually to a point. Costal and anal projections from valva base near vinculum. Costal projection very large in *N. similis*. Anal projections on anal edge of valva often extending upward toward coastal region. Single coremata arising from basal, dorsal area of valva. Juxta broad, two fused plates, medially with indentation of varying size. Annella variable but rarely expanded medially. Saccus slightly pointed anteriorly, rounded in *N. similis*. Aedeagus sclerotized for posterior 2/3, broad and shortened with basal end swollen and unsclerotized, often upturned at tip. Ductus subterminal. Vesica a complex series of evaginations. No cornuti but surface granulated. *Female genitalia* – Anal papillae tapered and slightly pointed dorsally. Posterior apophyses longer than anterior apophyses. Lodix (sclerotized central plate on the 7th sternite that arises from the anterior displacement of the ostial opening, leaving a plate derived from the sternite over the ostium) shape species specific, often expanded over ostial opening. Bursa attached to base of seventh sternite. Ductus bursae short, sclerotized for at least half its length (posterior end). Bursa ovate, variable but with well-differentiated bursa appendix arising posterior and ventral to bursa. Signa absent.

Key to the species of *Neadysgonia*

1. Forewing with postmedial line well defined and with one or two points directed to wing margin **2**
– Forewing with postmedial line not well defined, broad, with at most a vague point directed to base of apical mark..... ***N. similis***
2. Single point on well defined postmedial line directed to base of apical spot.. ..... ***N. consobrina***
– Two well defined, well separated points on postmedial line **3**
3. Male **4**
– Female **5**
4. Medial projection of tegumen at least 1/2 length of costal margin of valva... ..... ***N. smithii***
– Medial projection of tegumen less than 1/2 length of costal margin of valva.... ..... ***N. telma***

5. Lateral edge of lodix separated from main plate by less than width of base of lateral projection of lodix ..... ***N. smithii***
– Lateral edge of lodix separated from main plate by distance greater than width of base of lateral projection of lodix .....***N. telma***

***Neadysgonia similis* (Guenée), comb. n.**
Figs 1, 2, 7a, b, 11

Ophiusa smithii Guenée *in* Boisduval and Guenée, 1852: 267.

Type material. This species was described from an unknown number of specimens from an unknown locality. The short description is adequate to distinguish the species. The location of any types is unknown (not in BMNH, MNHN, or USNM).

Diagnosis. *Neadysgonia similis* can be recognized by the lack of well-defined triangles from the PM line and no dark shading basal of the AM line. Two forms occur, one devoid of any well-defined pattern between the AM and PM lines. In the male genitalia the projection from the tegumen creates a square shape and the costal projection of the valva ends in a hammerhead. In the female the lodix is rectangular.

Distribution and biology. *Neadysgonia similis* has been recorded from North Carolina to Florida. The food plant occurs in Alabama and Mississippi and the moth could be expected from these areas as well.

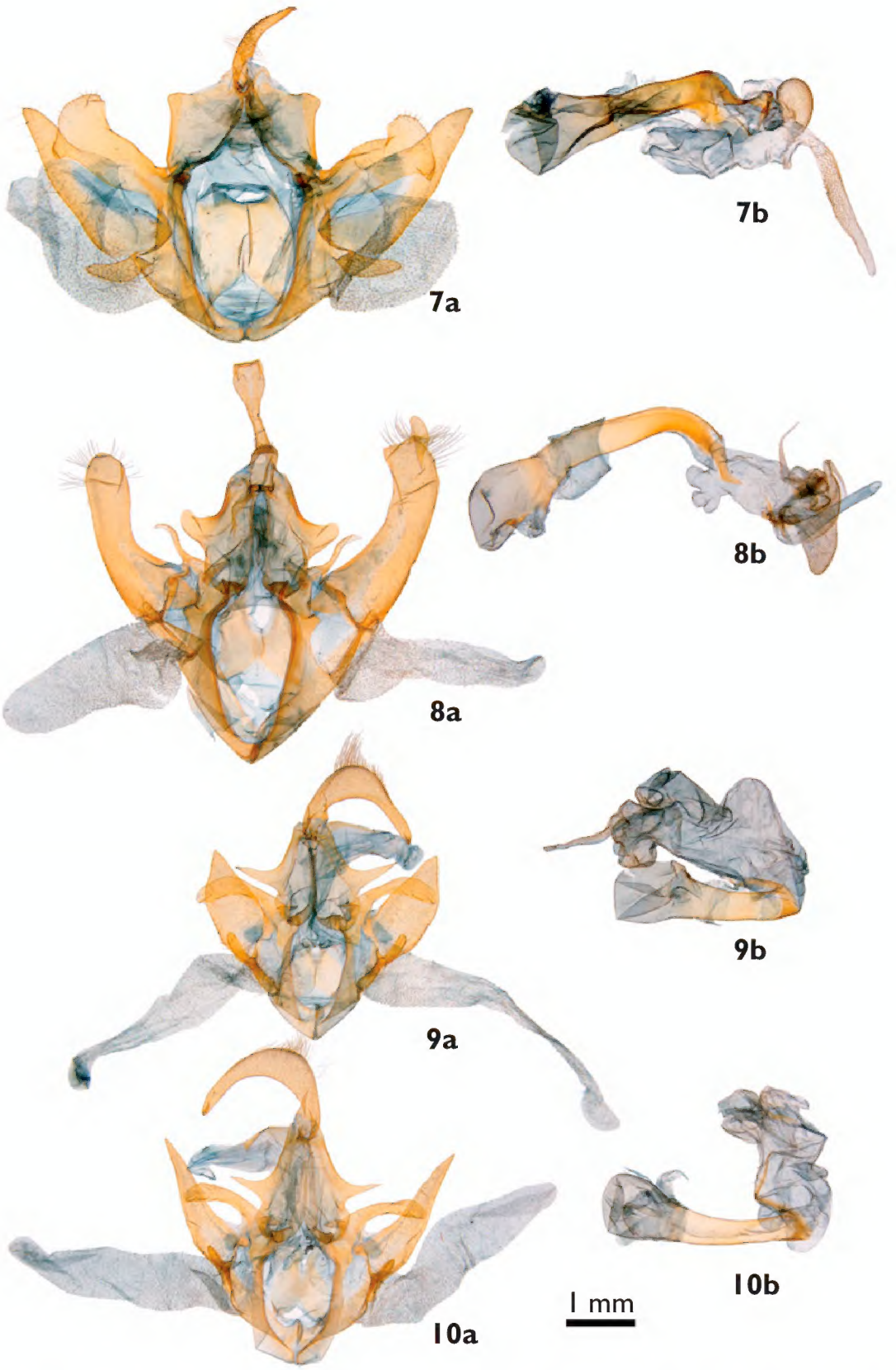
A larva of *N. similis* was collected from Loblolly Bay (*Gordonia lasianthus* (L.) (Theaceae)) by Richard Broadwell during the course of a study to determine the non-target effects of *Bacillus* treatments to eradicate a Gypsy moth infestation near Wilmington, N.C. (Hall et al. 1999). I identified the emergent moth as *Neadysgonia similis* and have subsequently found additional larvae and reared larvae from eggs from a captive female; all readily fed to maturity on Loblolly Bay. It is a common plant on the frequently burned coastal plain savannas, but both the adults and larvae are relatively uncommon. The moth is multiple brooded (April to September).

***Neadysgonia consobrina* (Guenée), comb. n.**
Figs 3, 8a, b, 12

Ophiusa consobrina Guenée *in* Boisduval and Guenée, 1852: 267.

Type material. *Neadysgonia consobrina*, like *N. similis*, was described from an unknown number of specimens from an unknown locality. The brief description allows identification of the species and the material probably originated from near Savannah, Georgia. No type has ever been located.

Diagnosis. This species is distinguished by a single triangular outward projection on the PM line. In the male genitalia the uncus is spatulate and the projection from the



Figures 7–10. Male genitalia of *Neadysgonia.* **a** valvea **b** aedeagus. **7a,b** *Neadysgonia similis* (Gn.). Carteret Co., North Carolina (JBS 2750) **8a,b** *Neadysgonia consobrina* (Gn.). St. Tammany Parish, Louisiana (JBS 2754) **9a,b** *Neadysgonia smithii* (Gn.). Jones Co., North Carolina (JBS 2749). Same data as male valves **10a,b** *Neadysgonia telma* Sullivan. Holotype. Columbus Co., North Carolina (JBS 2752).

tegumen is rounded. In females the lodix is trapezoidal and the ostial opening forms a horizontal concave line, i.e. smile.

Distribution and biology. *Neadysgonia consobrina* occurs from North Carolina to Louisiana. Specimens have been recorded from all of the southeastern states in the range except Alabama and Tennessee. The food plant of the species is unknown. The species is multiple brooded.

***Neadysgonia smithii* (Guenée), comb. n.**
Figs 4, 9a, b, 13

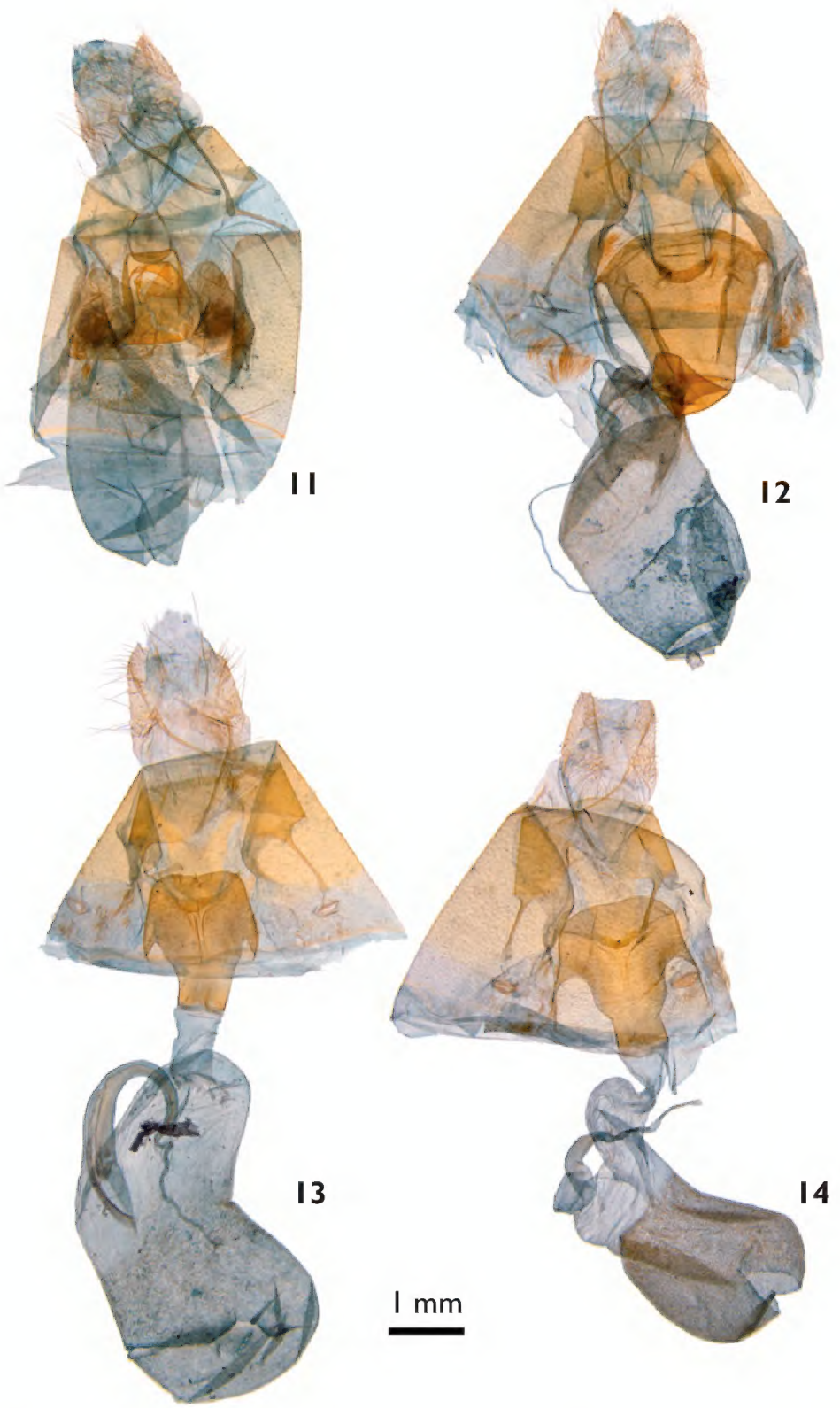
Ophiusa smithii Guenée *in* Boisduval and Guenée, 1852: 266, pl. 22, fig. 4.

Type material. *Neadysgonia smithii* was either described from an unknown number of specimens from an unknown locality, or it may have been described from a painting by John Abbot and sent to his colleague at the British Museum, J. E. Smith who in turn sent it to Guenée. As stated above, the type locality was probably near Savannah, Georgia. The location of any type material is unknown. The identity of *Ophiusa smithii* Guenée can not be determined from the published illustration, or from the original description, so a **neotype** is hereby designated: male, "April 24, 1974, Wedge Plantation, McClellensville, S. C., D. C. Ferguson," so labeled and located in USNM. I have dissected it and the slide number is USNM 50786.

Material dissected and/or barcoded. USA. Alabama: Munroe Co.; Georgia: no location (USNM 50787); Mississippi: Forest, Franklin, Grenada, Hinds, Rankin, Tishomingo, and Warren Counties; Missouri: Greene Co.; North Carolina: Brunswick, Carteret, Craven, Jones Counties; South Carolina: Charleston Co.; Texas: Jasper Co.

Note. This species as well as *N. similis* and *N. consobrina* were all described by Guenée at the same time in the genus *Ophiusa* and probably from specimens or paintings he received from Abbot via Smith. They probably originated from eastern Georgia or South Carolina in the vicinity of Savannah, where Abbot lived. The brief description of *N. smithii* by Guenée and accompanying painting could refer to one of two externally similar species, one of which is described as new below. Neither the description nor the painting of the species that served as a model for the description can be identified as to species. However, Abbot also painted the caterpillar and Guenée included a brief description of it as well. Most importantly, the food plant was identified as *Fagus ferruginea* Aiton (now *Fagus grandifolia* Ehrhart) and the pupae was said to be covered with a thick efflorescence of white purple. A white, waxy bloom on the pupa is characteristic of *N. similis* as well as species of *Argyrostrotis* Hübner and *Catocala* Schrank. Apparently *N. smithii* has not been reared again but beech trees are characteristic of mesic forests in the coastal plain and do not occur in the swamp forests where the new species *N. telma* has been collected.

Diagnosis. Adults of *N. smithii* are readily distinguished from *N. consobrina* and *N. similis* by the two triangular outward projections of the PM line. However, there is no reliable external character to distinguish it from the newly described species, *N. telma*. Upon dissection of the male genitalia *N. smithii* has a shorter and broader valva and the medial projection on the tegumen is more than half the length of the valva. In *N. telma* the valva is much narrower and longer and the medial projection of the tegumen is rarely as long as half the length of the valva. In females of *N. smithii* the distance between the lateral edges of the lodix and the main plate is less than the thickness of the lateral edge at its base. In *N. telma* this distance is much greater than the width of the base of the lateral edge.



Figures 11–14. *Neadysgonia* female genitalia. **11** *Neadysgonia similis* (Gn.). Craven Co., North Carolina (JBS 2863) **12** *Neadysgonia consobrina* (Gn.). St. Tammany Parish, Louisiana (JBS 2755) **13** *Neadysgonia smithii* (Gn.). Brunswick Co., North Carolina (JBS 2756) **14** *Neadysgonia telma* Sullivan. St. Tammany Parish, Louisiana (JBS 2784).

Distribution and biology. *Neadysgonia smithii* occurs throughout North Carolina and southward to Georgia and westward to Texas northward in the Mississippi Valley to Missouri. It is not yet recorded from Virginia, Florida, Louisiana or Arkansas, although it does occur close by and would be expected in those states as well. *Neadysgonia smithii* occurs in open savanna and mesic woodland habitats. The adults are multiple brooded.

***Neadysgonia telma* Sullivan, sp. n.**
urn:lsid:zoobank.org:act:2C1288EE-74E4-45D8-BE9C-E8E4E0AD79E5
Figs 5–6, 10a, b, 14

Type material. Holotype male: USA, North Carolina: Columbus Co., Lake Waccamaw State Park, Standing water swamp forest, June 21, 2009, uv trap, J. B. Sullivan. USNM. Paratypes: 4 ♂, 5 ♀: USA, North Carolina: Cumberland Co., Ft. Bragg, McPherson Creek at FB1, May 16, 2002, ♂; Robeson Co., Lumber River St. Pk., river bottomland, Sept. 18, 2009, ♂; Craven Co., Croatan Natl. For. Rd. 167, July 21, 1993, ♀; Columbus Co., Lake Waccamaw St. Pk., Standing water swamp forest, Sept. 19, 2009, ♀, all collected by J. B. Sullivan. Louisiana: St. Tammany Parish, 4.2 mi. NE Abita prings, V. A. Brou, ♀ (BMNH, CNC, JBS). Mississippi: Oktibbeha Co., Doraen Lake, April 16, 1990, Pat Porter, ♂; George Co., 3 mi. N. Lucedale, March 19–31, 1996, R. Kergosien, ♀; Franklin Co., Porter Creek, April 8, 1992, J. MacGown, T. Schiefer, ♀; Washington Co., Stoneville Exp. Sta. May 18–31, 1986, R. E. Furr, Jr., ♀ (MEM).

Dissected or Bar Coded Specimens. Florida: Liberty Co.; Georgia: DeKalb Co.; Indiana: Posey Co.; Louisiana: Bossier, St. Tammany Counties; Mississippi: Franklin, George, Harrison, Hinds, Oktibbeha, Pike, Tishomingo, Warren, Washington Counties; North Carolina: Carteret, Columbus, Cumberland, Robeson Counties; South Carolina: Charleston Co.; Texas: no location (USNM 40345), Jasper Co.

Etymology. The Greek word *telma* refers to standing water. Specimens from North Carolina and Florida are associated with hydric forests in the Coastal Plain.

Diagnosis. Wing length 19–20 mm. *Neadysgonia telma* is very similar in maculation to *Neadysgonia smithii*. In some populations it is possible to differentiate most specimens of the two species by wing pattern but certain identification requires dissection or barcoding. The two species can be identified by DNA barcoding and by differences in the male and female genitalia. Male genitalia differ slightly if at all from those of *N. smithii* in many genital characters, but the valvae and the lateral process of the tegumen allow the two species to readily be distinguished. In *N. telma* the valva is much thinner and tapers to a sharp point. In *N. smithii* the valva is broad and tapers gradually to a somewhat broad point. The lateral process of the tegumen is less than half the length of the costal edge of the valva in *N. telma*, but more than half the valva length in *N. smithii*. The anal projection at the base of the valva of *N. telma* is shorter and more sclerotized than that of *N. smithii*. Both species have a medially enlarged uncus with a slightly bifurcate tip, the tegumen has a pronounced lateral projection and both species have similar coremata arising from the dorsal base of the valva. The ranges of the two species appear to overlap substantially, the exact details of which will only be determined by dissection and barcoding of additional specimens.

Description. *Head* – Tongue normal, palps slightly porrect, second segment 2.5 × as long as first and third segments. Palps brown scaled with cream scales interspersed throughout, inner faces cream. Frons denuded basally, scales of head projecting forward, brown with cream scales, scape cream, antenna fasciculate with encircling rows

of tan with cream scales laterally. *Thorax* – Collar and vestiture covered with brown hairlike scales interspersed with cream-colored scales; tegulae similarly scaled but with some scales spatulate; abdomen brown with some cream scales dorsally, cream ventrally. Legs brown with cream scaling interspersed and forming cream bands at distal ends of tarsal joints. Tibial segments normal, not swollen. Two pairs of tibial spines on hind leg, single pair on middle leg twice as long as those on hind leg. Forewing pattern with ground brown with dark-purplish scaling. Apical trapezoidal spot distinct, post medial line with two major triangular points directed toward wing margin. Line light but inwardly bordered by a broad purple-brown band that fades toward medial line, which is slightly sinuous or straight, light colored but with darker scaling inward fading to wing base. Wing margin with two bands, inner one gray speckled with brown, outer band tan. Scaling distal to postmedial line gray with purple scales interspersed, becoming lighter toward margin. Hindwing fuscous with two marginal bands like those on forewing. Underside of hindwing fuscous with traces of lines visible, medial most prominent, discal spot faint. *Male genitalia* – (Figs 10a, b). Uncus broad at base, expanding medially and curving 180 degrees and tapering to tip, which is bifurcate. Dorsal setae shorter than medial width. Tegumen moderately broad with outward lateral triangular projection, tapering to sharp point, length less than ½ length of valva. Base of tegumen with sclerite that joins vinculum. Paired sclerites extend from junction with vinculum to base of uncus. Vinculum moderately broad, oval shaped forming a slight posterior projection where vincula arms meet anteriorly. No differentiated saccus. Juxta broad, paired plates lightly sclerotized and forming dorsal and ventral intrusions at junction. Valva triangular, extending to a point with projections dorsally and ventrally. Dorsal projection broad, finger shaped curving anteriorly and only slightly shorter than valva. Ventral projection finger shaped, straight, sclerotized and 1/4 length of valva with slightly raised ridge along ventral margin of valva. Aedeagus approximately length of valva, bulbous anteriorly and tapering toward tip. Basal third of aedeagus unsclerotized; ductus entering subterminally. Tip of aedeagus rounded, striated and continuing as a sclerotized ribbon onto vesica for half its length. Everted vesica moderately broad with numerous short, broad evaginations that are granulated toward distal end of vesica. Small patch of sclerotization on distal end of vesica. Pelt lacks distinct structures. *Female genitalia* – (Figs 14a, b): Anal papillae small, lightly sclerotized with setae from raised pimple-like bases. Posterior apophyses with spatulate tips, slightly longer and thinner than anterior apophyses. Genital plate trapezoidal with broad ostial opening that is lightly attached to 7th sclerite. Plate tapers anteriorly on both lateral sides to a thread-like tip, which is broadly separated from base of plate. Medial genital plate tapers to join ductus. Distance between lateral thread-like anterior extensions and lodix will allow *N. telmus* to be differentiated from *N. smithii*. Ductus bursae sclerotized posteriorly, short and tapering slightly to corpus bursa. Posterior end of corpus bursa wrinkled, unsclerotized and expanding to granulated body of corpus bursa. Appendix bursae to right and ventral to corpus bursae and tapering to the ductus. Appendix bursae and ductus unsclerotized. Signum absent. No unusual structural features on pelt.

Distribution and biology. *Neadysgonia telma* occurs from North Carolina southward at least to the Florida Panhandle and westward to Texas, with one record farther north from Indiana. The impression from localities where it has been collected is that *Neadysgonia telma* occurs in swamp forests where there is standing water. In this habitat red maples tend to dominate emergent forests whereas mature forests are more mixed with cypress often the dominant large tree. Moth multiple brooded throughout its range with dates from April through September.

Discussion

The three original species of *Neadysgonia* were described in the genus *Ophiusa* Ochsenheimer. Hampson placed them in *Parallelia* Hübner and Poole (1989) moved them to *Dysgonia*. *Dysgonia* was placed in the tribe *Ophiusini* by Fibiger and Lafontaine (2005) before being moved to the *Poaphilini* by Lafontaine and Schmidt (2010) along with *Argyrostrotis* Hübner and *Parallelia* Hübner. Barcoding and morphological characters of the genitalia place them with members of the genus *Argyrostrotis* and nearest neighbor analyses place the species *A. anilis* with *Neadysgonia*. *Argyrostrotis* and *Neadysgonia* share many characters in the larvae and the adult and they occur in the same kinds of habitats (for the most part, coastal plain savannas and wetlands). *N. smithii* and *A. anilis* occur in a broader array of habitats. In comparing *Argyrostrotis* species, the basal projections of the valvae are enhanced whereas in *Neadysgonia* species the tegumens are frequently modified as well. Both genera have a lodix in the female genitalia, both genera have strongly spined tibiae but adults differ considerably in size. Until more is known about the life histories, it seems best to treat them as separate genera.

There are four neotropical species currently placed in *Dysgonia* (Poole, l989). The male genitalia of these species have two coremata and a superuncus, thus placing them closer to *Ophiusa* Ochsenheimer and its allies. They will be dealt with separately.

The discovery of *N. telma* is a good example of barcoding revealing a cryptic species complex. Hugo Kons, Jr. and Robert Borth had barcoded presumed *N. smithii* from Florida, Texas, and Indiana. They were conspecific. I had barcoded numerous *N. smithii* as well, but it was not until I collected and barcoded an apparent *N. smithii* from Waccamaw Lake State Park in Columbus Co., North Carolina, that I realized two species were present under the name *N. smithii*. When our data were combined, two well-differentiated groups were obvious, true *N. smithii* from eastern North Carolina and *N. telma* from North Carolina, Florida, Texas and Indiana. Further study of barcoded specimens from the two groups revealed obvious genitalic differences. Dissection of over 50 specimens from throughout the ranges showed distribution patterns which were largely overlapping. A single specimen collected by Kohns and Borth from Medina County in the hill country of Texas west of San Antonio could not be placed with certainty. It has been barcoded and pictures of the adult and its genitalia were sent by Hugo Kons, Jr. and are most similar to *N. smithii*, but not clearly identical. Additional specimens may be needed to determine whether this population is *N. smithii*

or perhaps an undescribed species but its barcode differed from *N. smithii* from North Carolina by less than 1%, not an unexpected number for members from the extremities of a species' range.

Although the distribution of the two species by county shows numerous examples of both species occurring in the same county throughout their ranges, both Kons and Borth (2006) and I noticed that *N. telma* is most often found in or near swamps with standing water. *N. smithii* occurs in more upland habitats and has been taken above 2500' in the mountains of North Carolina (based on fascies but not dissected). Abbot's rearing of a larva on *Fagus* is consistent with the capture of *N. smithii* in the mountains, piedmont, and upland coastal plain habitats. Additional life history data for both species should reveal how they coexist over most of their ranges.

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